AMENDMENTS TO THE DRAWINGS

The enclosed replacement drawing sheet includes an amended version of Figure 1. As requested by the Examiner, Applicant has amended Figure 1 in order to identify the Z-axis as representing "entities" (not time). Applicant respectfully requests entry of the enclosed replacement drawing sheet.

Enclosure: Replacement Drawing Sheet

REMARKS/ARGUMENTS

STATUS OF THE CLAIMS

Applicant has amended Claims 8, 10, 12, 15-18, and 20-21. Applicant has added new Claim 22. Applicant respectfully requests reconsideration of pending Claims 2, 6-12, 15-18, and 20-22 in view of the following remarks.

OBJECTION TO THE SPECIFICATION

As requested by the Examiner, Applicant has provided a new abstract of the disclosure that is written in narrative form. Applicant respectfully requests withdrawal of the objection to the specification.

OBJECTIONS TO THE DRAWINGS

As requested by the Examiner, Applicant has amended Figure 1 to identify the Z-axis as representing "entities" (not time). Applicant respectfully requests withdrawal of the objection to the drawings.

CLAIM REJECTIONS – 35. U.S.C. § 112

Claims 12, 15-18, and 20-21 stand rejected under 35 U.S.C § 112, first paragraph, as not being enabled. The Examiner asserts that the following claim language is not enabled by the specification: "performing updating and deleting operations on the values of attributes by inserting into the database a new insert summary position with a new particular transaction time without altering any existing summary position, logical update and delete of valid start time and valid end time of an attributed achieved by inserting the new summary position with a different value start time or valid end time that is to be true for the particular transaction time." Applicant respectfully traverses this rejection.

Applicant respectfully submits that the subject matter of Claims 12, 15-18, and 20-21 is sufficiently described in the specification so that a person of ordinary skill in the art (*e.g.*, a database administrator or designer) would be able to make and use the invention based on the specification. The language recited in Claims 12, 15-18, and 20-21 is enabled because the specification of the present application describes embodiments of the invention that provide insert-only models that perform updates and deletes by inserting new summary positions, not by actually updating or deleting information stored in database. For example, the specification of the present application recites:

> Referring now to FIG. 1, the key to achieving this breakthrough is the realisation that existing theories are struggling because they allow update and delete actions to be performed on data. This invention avoids such complexities since updates and deletes are implemented as inserts into a Summary Position 112, 114, 116 held in a Time Cube i.e. an Insert-only module. This invention defines a Core algorithm used by the system to build the next Summary Position as each event (insert, update, delete) occurs. A summary Position is a collection of objects that defines all the attribute values of an entity over X-time.

Present Application, paragraph 297, lines 1-11.

The specification of the present application also provides the following example of the effects of transactions and the resulting creation of Summary Positions:

> At 132 the employee record came into being thus a Summary Position is created where prior to 132 (i.e., to the left of 132), the employee record did not exist and therefore attributes items have, referring to FIG. 12, a Non Existence value 1204. To the right of 132 the employee record is deemed to exist to the end of system time 122 and therefore from this point attributes may have values. The second transaction has the effect of altering the insert time for the employee from 132 to 118. Thus row 114 shows the Summary Position reflecting the effect of the second transaction. The third transaction has the effect of deleting the employee at 120. Thus row 116 reflects the Summary Position of the effect of the third transaction. To the right of 120 the employee is now deemed deleted until the end of the system time 122.

Present Application, paragraph 343, lines 4-18.

In light of the above portions of the specification and the additional, numerous descriptions and examples included in the specification and drawings of the present application, a person of ordinary skill in the art would be able to make and use the claimed invention. One of ordinary skill in the art, at the time the invention was made, having a general knowledge of database management systems (*e.g.*, a database designer) would be able to design a database and a corresponding database management system that includes logic or rules that performed updating and deleting operations on values of attributes stored in the database by inserting a new insert summary position into the database with a new particular transaction time, without altering any existing summary position stored in the database.

Accordingly, Applicant respectfully requests withdrawal of the rejection of Claims 12, 15-18, and 20 under 35 U.S.C. § 112, first paragraph.

CLAIM REJECTIONS – 35 U.S.C. § 101

Claims 12, 15-18, and 20-21 stand rejected under 35 U.S.C. § 101 as being unsupported by either a claimed utility or a well-established utility. The Examiner asserts that the following language of the claims does not have a useful concrete and tangible result: "inserting the new summary position with a different valid start time or valid end time that is true for the new particular transaction time." Applicant respectfully traverses this rejection.

First, Applicant has amended Claims 12, 15-18, and 20-21 to recite a "computer-implemented database" or a "computer-implemented method." Second, Applicant respectfully submits that Claims 12, 15-18, and 20-21 do specify a useful concrete and tangible result. Claims 12, 15-18, and 20-21 are directed to generating and inserting data items into a database. The data items include particular values (*e.g.*, an allowable value, start time of the allowable value, an end time of the allowable value, and a Y-time or transaction time). The data items are useful in a temporal database system to preserve previous states of a database. Also, a transaction time representing the time at which data is inserted in a database is useful to preserve previous states of a data item and to allow a user to access previous states of a data item. As

described in the specification of the present application, preserving previous states of a data entity is useful to "turn the clock back" and see what the answer to a particular query would have been if the query had been issued at a particular time or against a particular state of a database. The following example is given in the present application:

> "[T]he value of an attribute of a database entry is often not static in time. For example, Mr Smith may really have started a week later. If this is discovered on, say, 10 Jun. 2003, and corrected that day in the database, an enquiry performed on 9th June 2003 would say Mr Smith joined on 1 Mar. 1995. The same enquiry performed on 11 Jun. 2003 would say he joined on 8th Mar. 1995.

For the above example, an individual may want to know the answer to the query "When did Mr. Smith join?" if the query were issued on June 9, 2003. The present invention can provide a simple solution to the problem in the above example, and thus, is useful to retain previous states of a database or data items so that the previous states can be accessed to answer a query. Accordingly, Applicant respectfully requests withdrawal of the rejection of Claims 12, 15-18, and 20-21 under 35 U.S.C. § 101.

CLAIM REJECTIONS – 35 U.S.C. § 102

Independent Claims 12, 15, 16, 17, 18, 20, and 21

Independent Claims 12, 15, 16, 17, 18, 20, and 21 each stand rejected under 35 U.S.C § 102(e), as being anticipated by United States Patent No. 6,754,657, issued to Lomet. ("Lomet").

Amended Claim 12 specifies "with update and delete functions being achievable by insert events that do not alter existing start times and end times stored in the database." Amended Claim 15 specifies "wherein all logical delete update and insert operations are achieved by physical insert operations inserting new values of attributes and inserting new start times and/or end times associated with the new values without altering existing start times or end times stored in the database." Amended Claim 16 specifies "achieving logical update and delete operations on said start and end times stored in the database by inserting new entries in the database without

altering existing entries in the database, the new entries being associated with a different transaction time." Amended Claim 17 specifies "performing logical update or delete of the start of valid time by performing an insert operation to insert a new entry into the database having a modified start of valid time, the existing entry remaining unchanged." Amended Claim 18 specifies "wherein logical delete and logical update are performed by inserting a new summary position with appropriate transaction time and start and optionally end times for an associated value for an attribute and without altering existing summary positions stored in the database." Amended Claim 20 specifies "logical update or delete operations being achieved by an insert of a new database entry having a different transaction time, the previous entries remaining unchanged." Amended Claim 21 specifies "performing updating and deleting logical operations on the values of attributes by inserting into the database a new insert summary position with a new particular transaction time without altering any existing summary position." (Underlining added for emphasis only.)

Lomet discloses an improved method of setting timestamps associated with data items that are consistent with the order in which transactions involving data items are executed or committed. *Lomet*, col. 6, lines 45-50. Lomet discloses setting upper and lower bounds for a transaction timestamp before a final transaction timestamp is assigned. *Id.* at col. 6, lines 49-63. When deleting a data item, Lomet discloses that the timestamp associated with the delete transaction (*e.g.*, the time at which the delete transaction is issued) becomes the end time for the deleted data item. That is, the existing end time of a data item being deleted is altered to be the current time or the time when the delete transaction is issued. *Id.* at col. 17, lines 65-67. Lomet further discloses altering the existing end time of a data item to a variable called "now," which is continuously altered to match the current time. *Id.* at col. 1, lines 45-48. Accordingly, Lomet discloses that when a data item is deleted, its existing end time is always altered to the current time.

When updating a data item, Lomet discloses that an update transaction is accomplished by two writes or transactions. A first transaction "deletes" the existing data item (*i.e.*, alters the

existing data item's end time to the time associated with the first transaction), and a second transaction inserts a new "updated" data item. *Id.* at col. 17, line 65 and col. 18, lines 1-3. In other words, when a data item is updated, the data item is deleted (*i.e.*, the end time of the existing data item is altered to the current time), and a new data item is added. *Id.* at col. 1, lines 54-59. Accordingly, Lomet discloses that when a data item is updated, its existing end time is always altered to the current time.

In summary, Lomet discloses altering the existing end time whenever a data item is either deleted or updated. As a result, Lomet does not discloses "update and delete functions being achievable by insert events that <u>do not alter existing start times and end times</u> stored in the database," as specified by amended Claim 12. Similarly, Lomet does not disclose the subject matter of independent Claims 15, 16, 17, 18, 20, and 21, as noted above. Thus, independent Claims 12, 15, 16, 17, 18, 20, and 21 and dependent Claims 2 and 6-11 are allowable.

CLAIMS REJECTIONS – 35 U.S.C. § 103

Claims 8 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lomet in further view of U.S. Patent No. 5,179,650, issued to Fukui et al. Claims 8 and 9 depend from Claim 21 and are therefore allowable for the reasons discussed above with respect to Claim 21. Claims 8 and 9 include additional patentable subject matter not specifically discussed herein.
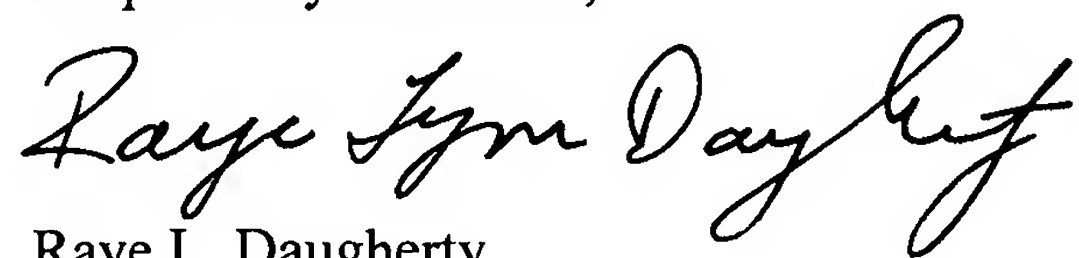
NEW CLAIM

Applicant has added new Claim 22, which specifies "performing updating and deleting logical operations on the value of the attribute by inserting into the database a second summary position including a new transaction time <u>without altering the first summary position</u>." Accordingly, new Claim 22 is allowable for the reasons set forth above with respect to Claims 12, 15-18, and 20-21.

CONCLUSION

In light of the above, Applicant respectfully requests allowance of pending Claims 2, 6-12, 15-18, and 20-22.

Respectfully submitted,

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